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PATENT ABSTRACTS OF JAPAN

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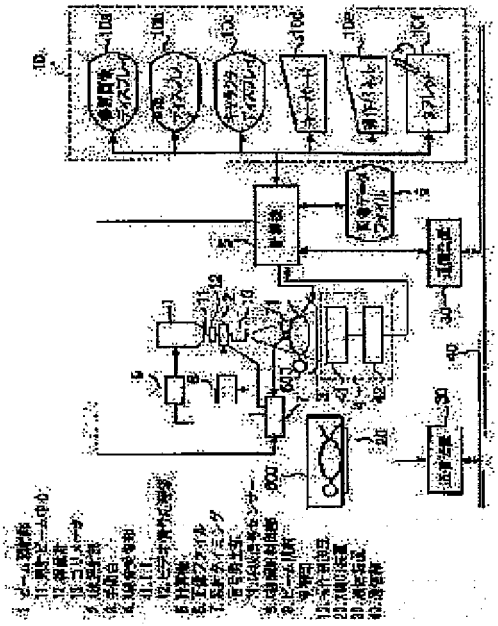
(54) BEAM IRRADIATION TREATMENT DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To enable to check the position of a site to be treated which moves according to moving of a human body with reduced quantity of radiation exposure.
SOLUTION: To collect position information of a site to be treated, the site to be treated is irradiated with an X-ray by using an irradiation timing signal which synchronizes with the respiration cycle of a patient and is generated in a part of period thereof. The difference between the position of the site to be treated and the central position of an irradiating beam is determined by using the position information of the site to be treated. Position control is performed so that the difference is within a predetermined accuracy, and then, the site is irradiated with beams by using the irradiation timing signal generated in a part of the period of the respiration cycle of the patient. By thus constituting, a beam irradiation treatment device with the reduced quantity of radiation exposure can be obtained.



JP,2001-161839,A [CLAIMS] machine translation of Ref. 2 1/1 ページ

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CLAIMS

[Claim(s)]
[Claim 1]A beam irradiation therapeutic device comprising:
An irradiation timing signal generator which is controlled synchronizing with a patient's spirogram signal and generates an irradiation timing signal in a specific period of one cycle of this spirogram signal.
An X-ray irradiation part which irradiates with X-rays a portion which is controlled by this irradiation timing signal and includes a patient's treated area.
An X-ray image television part which televises an X-ray image acquired by the exposure of these X-rays.
A localization part which checks a position of said treated area by comparison of picture information including a patient's treated area prepared beforehand and picture information obtained from said X-ray image television part, and a beam irradiation part which irradiates with a beam for a therapy with said irradiation timing signal.

[Claim 2]A beam irradiation therapeutic device comprising:
An irradiation timing signal generator which is controlled synchronizing with a patient's spirogram signal and generates an irradiation timing signal in a specific period of one cycle of this spirogram signal.
An X-ray irradiation part which irradiates with X-rays a portion which is controlled by this irradiation timing signal and includes a patient's treated area.
An X-ray image television part which televises an X-ray image acquired by the exposure of these X-rays.
Picture information of an X-ray CT image including a patient's treated area prepared beforehand, and a localization part which checks a position of said treated area by comparison of picture information obtained from said X-ray image television part, A position control part which it is controlled by a signal from a localization part, and is controlled in the direction which loses a position gap with a position of said treated area, and the center of an irradiation field of a beam for a therapy, A beam irradiation part which is controlled by an irradiation timing signal by a patient's treated area, and irradiates with a beam for a therapy after an end of position control by said position control part, A beam irradiation part which irradiates with a beam for a therapy with said irradiation timing signal after said irradiation timing signal's performing X-ray irradiation and performing position gap amendment with localization of a patient's treated area.

[Claim 3]The beam irradiation therapeutic device according to claim 1 or 2 synchronizing with a spirogram signal and performing generation of a control signal by said timing signal generation part during the expiration.
[Claim 4]The beam irradiation therapeutic device according to any one of claims 1 to 3 which drives a beam irradiation part and irradiates a treated area with a beam for a therapy on condition that a position gap with a position of a treated area and the center of an irradiation field of a beam for a therapy which were acquired from said X ray image pick-up part is below a predetermined value.
[Claim 5]The beam irradiation therapeutic device according to any one of claims 1 to 4, wherein said X-ray irradiation part enables it to irradiate with a beam for a therapy, without arranging in a position which does not lap with an irradiation field of a beam for a therapy with which it irradiates towards a treated area, and moving an X-ray irradiation part.
[Claim 6]A specific period in 1 cycle of said spirogram signal is divided in two or more periods, the beam irradiation therapeutic device according to any one of claims 1 to 5 assigning at an irradiation period of X-rays, and an irradiation period of a beam for a therapy, coming out, respectively, and generating an irradiation timing signal of X-rays, and an irradiation timing signal of a beam.
[Claim 7]The beam irradiation therapeutic device according to any one of claims 1 to 6 collecting information which irradiates with X-rays a portion including a treated area from 2 crossing or 2 or more directions, and starts a position of a treated area from the X-ray image.
[Claim 8]The beam irradiation therapeutic device according to any one of claims 1 to 6, wherein a beam for a therapy is X-rays, an electron beam, a charged particle beam, a heavy particle beam, or a neutron beam.
[Claim 9]A beam irradiation therapeutic device comprising:
An irradiation timing signal generator which generates an irradiation timing signal in a periodic period in a constant level of a periodic spirogram signal by a patient.
A beam irradiation part which irradiates a patient's treated area with a beam for a therapy synchronizing with said irradiation timing signal after receiving a localization signal.
An X-ray irradiation part which irradiates with X-rays a portion which includes a patient's treated area before an exposure of a beam for a therapy by this beam irradiation part synchronizing with said irradiation timing signal.
An X-ray image television part which televises an X-ray image by exposure of X-rays from this X-ray irradiation part, and a calculation part which checks a position of a patient's treated area and outputs said localization signal to said beam irradiation part.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the beam irradiation therapeutic device which irradiates a patient's cure object part with beams, such as X-rays, an electron beam, a charged particle beam, a heavy particle beam, or a neutron beam (it is also called "exposure"), and treats a malignant tumor, for example, cancer etc.
[0002]
[Description of the Prior Art]The key map showing a conventional example in drawing 11 explains. In a figure, the X-ray irradiation part constituted from X-ray tube 201 etc. with which the beam irradiation part which 100 irradiates with beams, such as X-rays, an electron beam, a charged particle beam, a heavy particle beam, or a neutron beam, and 102 irradiate with a dosimeter, 103 irradiates with a collimator, and 200 irradiates with X-rays, and 300 are treatment tables. Usually, although the treatment table 300 has many things of a bed type, it is written with the chair type as a thing of an easy structure of explanation here. The beam irradiation part 100, the X-ray irradiation part 200, and the treatment table 300 are arranged on the same line. The image intensifier (henceforth I.I.) which carries out luminosity multiplication of the optical image with weak 410, and 420 are X-ray television which projects the X-ray image which passed the patient 600 from said X-ray irradiation part 200, and which came. The image data file of a portion including the treated area of the patient who is collecting 430 by X-ray CT etc. in advance of a therapy, 440 is localization operation part which compares position information including a patient's treated area constituted from image data obtained from the X-ray image and the image data file 430 of the portion including the treated area of the patient 600 who got by said X-ray television 420, and checks the position of the treated area of the patient 600 on the operating table 300. Although treated areas, such as cancer, cannot be directly checked in X-ray television 420, since skeletons are visible, By associating the skeleton image of the patient on the bed obtained according to the image data and X-ray image of the skeleton image including a patient's treated area constituted by the image data of the image data file 430, the relative physical relationship of a skeleton and a treated area can be grasped on X-ray television 420. The treatment table control section which performs alignment so that the position of the treated area which calculated 450 as mentioned above may agree with the center 101 (it is displayed as O in drawing 12) of the irradiation field of the beam from the beam irradiation part 100, The irradiation control part to which 500 performs irradiation control of the beam irradiation part 100, and 510 show a patient's respiration sensor, and 600 shows a patient.
[0003]Next, operation is explained. The key maps and drawing 13 in which the relation of the skeleton image M and the center O of the irradiation field of a beam that drawing 12 includes a patient's treated area K is shown are a patient's spirogram signal (drawing 13 (A)), an irradiation timing signal (drawing 13 (B)) of X-rays, and an irradiation timing signal (drawing 13 (C)) of a beam. The spirogram (drawing 13 (A)) goes back and forth between expiration and inhalation of air, and if stabilized, the cycle is presupposing that the deepest part of tau and expiration is it in t_0. First, a portion including a patient's treated area is continuously irradiated with X-rays from the X-ray irradiation part 200 (period of $deltat_1$ of drawing 13 (B)), and the X-ray image is acquired. Since an X-ray image moves by the movement toward breathing (respiratory movement), it catches and picturizes the image of the place which became the deepest part of expiration. Next, a screen including a skeleton and a treated area consists of data of the patient of the image data file 430. (drawing 12 (A)). piling up an X-ray image and the skeleton image constituted from information on the image data file 430 — bubble **** — if the position of a treatment table is adjusted like, as shown in drawing 12 (A), the treated area K can be pinpointed on an X-ray image. The position of the treatment table 300 is controlled by the treatment table control section 450 in agreement with the center O of the irradiation field of a beam in this treated area K, as shown in drawing 12 (B). As a result of control by the treatment table control section 450, if the center O of the treated area K and the irradiation field of a beam is in agreement in predetermined accuracy, the irradiation timing signal (signal of width $deltat_1$ of drawing 13 (C)) centering on deepest part t_0 of the spirogram will perform irradiation control of a beam.

[0004]
[Problem(s) to be Solved by the Invention]Since the conventional beam irradiation therapeutic device was constituted as mentioned above, the portion including a patient's treated area was continuously irradiated with X-rays from the X-ray irradiation part 200 and the localization of the treated area was performed, there was a problem that the amount of contamination of X-rays increased.
[0005]It is made in order that this invention may solve the above-mentioned problem, and it aims at lessening the amount of contamination of the X-rays by the X ray image pick-up used in order to check the position of a treated area.
[0006]
[Means for Solving the Problem]The beam irradiation therapeutic device of this invention according to claim 1, An irradiation timing signal generator which is controlled synchronizing with a patient's spirogram signal and generates an irradiation timing signal in a specific period of one cycle of this spirogram signal, An X-ray irradiation part which irradiates with X-rays a portion which is controlled by this irradiation timing signal and includes a patient's treated area, An X-ray image television part which televises an X-ray image acquired by the exposure of these X-rays, It has a localization part which checks a position of said treated area by comparison of picture information including a patient's treated area prepared beforehand and picture information obtained from said X-ray image television part, Localization of a patient's treated area is performed and it is made to irradiate by X-ray irradiation by an irradiation timing signal with a beam for a therapy based on the result.
[0007]The beam irradiation therapeutic device of this invention according to claim 2, An irradiation timing signal generator which

is controlled synchronizing with a patient's spirogram signal and generates an irradiation timing signal in a specific period of one cycle of this spirogram signal, An X-ray irradiation part which irradiates with X-rays a portion which is controlled by this irradiation timing signal and includes a patient's treated area, An X-ray image television part which televises an X-ray image acquired by the exposure of these X-rays, Picture information of an X-ray CT image including a patient's treated area prepared beforehand, and a localization part which checks a position of said treated area by comparison of picture information obtained from said X-ray image television part, A position control part which it is controlled by a signal from a localization part, and is controlled in the direction which loses a position gap with a position of said treated area, and the center of an irradiation field of a beam for a therapy, It has a beam irradiation part which is controlled by an irradiation timing signal by a patient's treated area, and irradiates with a beam for a therapy after an end of position control by said position control part, After an irradiation timing signal's performing X-ray irradiation and performing position gap amendment with localization of a patient's treated area, it is made to perform an exposure of a beam for a therapy.

[0008]In the beam irradiation therapeutic device of this invention according to claim 3, it synchronizes with spirogram and is made to perform generation of an irradiation timing signal by a timing signal generation part during the expiration.

[0009]The beam irradiation therapeutic device of this invention according to claim 4 drives a beam irradiation part, and it is made to irradiate a treated area with a beam for a therapy, on condition that a position gap with a position of a treated area and the center of an irradiation field of a beam for a therapy which were acquired from an X-ray image is below a predetermined value.

[0010]The beam irradiation therapeutic device of this invention according to claim 5 arranges an X-ray irradiation part in a position which does not lap with an irradiation field of a beam for a therapy with which it irradiates towards a treated area, and it enables it to irradiate with a beam for a therapy, without moving an X-ray irradiation part.

[0011]The beam irradiation therapeutic device of this invention according to claim 6 divides a specific period in 1 cycle of spirogram in two or more periods, and assigns generation of a control signal by a timing signal generation part a period of X-ray irradiation, and during the exposure of a beam for a therapy, respectively.

[0012]The beam irradiation therapeutic device of this invention according to claim 7 is made to collect information which irradiates with X-rays a portion including a treated area from 2 crossing or 2 or more directions, and starts a position of a treated area from that X-ray image.

[0013]A beam for a therapy of the beam irradiation therapeutic device of this invention according to claim 8 is X-rays, an electron beam, a charged particle beam, a heavy particle beam, or a neutron beam.

[0014]The beam irradiation therapeutic device of this invention according to claim 9 is characterized by comprising:

An irradiation timing signal generator which generates an irradiation timing signal in a periodic period in a constant level of a periodic spirogram signal by a patient.

A beam irradiation part which irradiates a patient's treated area with a beam for a therapy synchronizing with said irradiation timing signal after receiving a localization signal.

An X-ray irradiation part which irradiates with X-rays a portion which includes a patient's treated area before an exposure of a beam for a therapy by this beam irradiation part synchronizing with said irradiation timing signal.

An X-ray image television part which televises an X-ray image by exposure of X-rays from this X-ray irradiation part, and a calculation part which checks a position of a patient's treated area and outputs said localization signal to said beam irradiation part.

[0015]

[Embodiment of the Invention]Below embodiment 1. describes this embodiment of the invention 1 based on drawing 1, drawing 2, drawing 3, drawing 4, and drawing 5. The lineblock diagram and drawing 2 which drawing 1 requires for the embodiment of the invention 1 are a part drawing of the computer 5 and the irradiation timing signal generator 7 which requires explanation in detail especially. In drawing 1 and drawing 2, 1 is provided with the dosimeter 12 and the collimator 13 grade in the beam irradiation part, and shows the beam center line of the irradiation field by 11. The X-ray irradiation part provided with the X-ray tube with which 2 irradiates with X-rays, the operating table which treats by 3 picking up a patient, and 4 are the X-ray image television parts which televise the X-ray image which has passed the portion which includes the treated area of the patient of the treatment table 3 from said X-ray irradiation part 2, It has the image INSHI fire (it is hereafter written as I.I.) 41, the video-signal-processing part 42, etc. 5 is a computer which performs calculation for various control of this beam irradiation therapeutic device, generation of a control signal, etc., As an image comparison from the X-ray CT image accumulated in the image data file 6, When the image constituting part 51 which constitutes a ****** projection picture, the localization part 52 which compares this central projection picture and said X-ray image, and checks a patient's position, and the checked position have shifted from the prescribed position, for alignment. It has the localization information output part 54 grade for telling the irradiation timing signal generator 7 about the position control part 53 which controls the position of a treatment table, and this localization situation (drawing 2 (A)). 6 is an image data file which is accumulating the picture information by the X-ray CT of a portion including the patient's 600 treated area. 7 is an irradiation timing signal generator which generates the irradiation timing signal (drawing 5 (A), (B)) which synchronized with the patient's breathing based on the signal from the respiration-signals sensor 71 arranged to the patient's 600 thorax, etc., The localization in the spirogram signal generator 72 and the computer 5 which generate a spirogram signal (drawing 5 (A)) by the signal from the respiration-signals sensor 71. It corresponds to a control state. The control condition of an irradiation timing signal generator. The condition signal generating part 73 and the irradiation timing signal for X-rays to set up. The irradiation timing signal generator 74 for X-rays to generate, the irradiation timing signal generator 75 for beams which generates the irradiation timing signal for beams, and the X-ray irradiation part shunting control section 76 to which the X-ray irradiation part set on the line of a beam irradiation field in advance of the exposure of a beam is evacuated from on a beam line. It has (drawing 2 (B)). By this composition, an X-ray irradiation timing signal can be taken out until localization work finishes, but a beam irradiation timing signal cannot be taken out and carried out. In advance of beam irradiation, the X-ray irradiation part is evacuated from on the line of the irradiation field of a beam by the X-ray irradiation part shunting control section 76. The X-ray irradiation control section to which 8 performs irradiation control of said X-ray irradiation part 2, and 9 are beam irradiation control sections which perform irradiation control of said beam irradiation part 1. These control sections are controlled by the irradiation timing signal generated by said spirogram signal.

[0016]The image comparison display 10a which displays central projected pictures including a patient's treated area constituted using the X-ray CT image which is accumulating 10 in the image data file, It is the operation control part provided with the picture display 10b which displays a patient's X-ray image acquired by the X-rays from the X-ray irradiation part 2, the character display 10c, the keyboard 10d, the navigational panel 10e, the tablet 10f as which an electronic mark is entered in a display

screen, etc. An X-ray CT scanner with which 20 collects the picture information of the portion which includes the patient's 600 treated area in advance of a therapy, 30 is a communication apparatus, 40 is a communication wire, and the picture information of a portion including the treated area of the patient who collected with X-ray CT scanner 20 is accumulated in the image data file 6 through the communication apparatus 30, the communication line 40, and the computer 5.

[0017]In next, the explanatory view of the alignment procedure of doubling the position of the treated area K with the center O of the irradiation field of a beam which shows the flow of the therapy in this Embodiment 1 in the flow chart and drawing 4 of Embodiment 1 which are shown in drawing 3. Drawing 5 explains the relation of the irradiation timing signal of a patient's spirogram signal, X-ray irradiation, and beam irradiation. In drawing 3 and drawing 4, a portion that what attached the same agreement or name as drawing 1 and drawing 2 is the same as that of the thing of drawing 1 and drawing 2, or considerable is shown. In advance of a therapy, the picture information of the portion which includes the patient's 600 treated area first is collected using X-ray CT 20, and it records on the image data file 6 (drawing 3 step 1). The picture information (drawing 4 (A11)) of X-ray CT is incorporated into the computer 5 from the image data file 6, The television picture by the exposure of the X-ray tube of imagination is constituted using the image constituting part 51 (drawing 2 (A)) (drawing 4 (B11)), and this is displayed on the image comparison display 10a so that the central projection picture of the patient's 600 skeleton image P may be obtained (drawing 3 step 2). The display screen of this image comparison display 10a is a central projection picture of the patient's 600 skeleton image P, and the image K of the treated area is displayed in it (drawing 4 (C11)). An electronic mark (M1 of drawing 4 (C11), M2, M3) is attached to the intelligible position of this skeleton image by the tablet 10f (drawing 3 step 3).

[0018]Next, positioning which brings the treated area K to the center O of the irradiation field of a beam is explained. The patient 600 is put on the treatment table 3 (drawing 4 (A21)), the respiration signals detected by the respiration-signals sensor 71 generate a spirogram signal by the spirogram signal generator 72, and the waveform is supervised. And the irradiation timing signal which it has focusing on the deepest part (t_0 of drawing 5) of a spirogram signal in the place which breathing stabilized by the irradiation timing signal generator 75 for the (drawing 3 step 5) X-rays is generated (drawing 3 step 6), The X-ray image of the skeleton image which controls the X-ray irradiation part 2, irradiates with X-rays, and includes a patient's treated area is picturized. This X-ray image is displayed on the picture display 10b (the drawing 3 step 7 and the displayed picture are drawing 4 (B21)). The geometry distortion of the display screen is beforehand amended about the picture display 10b if needed. The skeleton image Q of the patient 600 who appears in the treatment table 3 actually has projected on this picture display 10b (drawing 4 (B21)). Then, an electronic mark (N1 of drawing 4 (B21), N2, N3) is attached to the electronic mark M1 of the reference screen display 10a of the screen currently displayed on the picture display 10b, M2, M3, and a corresponding position by the tablet 10f. (Drawing 3 step 8). O point on the picture display 10b shows the beam center of a beam.

[0019]Since the mark position (N1, N2, N3) in an X-ray image was matched with the mark position (M1, M2, M3) of the X-ray CT image and has been arranged by the above preparation, the position gap with the center O of the treated area K and the irradiation field of a beam is calculated by the localization part 52 of the computer 5 (drawing 3 step 3). Based on this calculation result, a control signal is sent to the treatment table 3 from the position control part 53 of the computer 5, and positioning of the treatment table 3 is performed in the direction which loses a gap (drawing 3 step 10). If positioning is performed, the following irradiation timing signal will perform X-ray irradiation again (drawing 3 step 11), and the result of positioning will be checked (drawing 3 step 12). When the center O of the treated area K and an irradiation field is in agreement in predetermined accuracy (drawing 4 (C22)), The signal is told to the irradiation timing signal generator 7, and the X-ray tube which is in the passage of the irradiation field of beams, such as the X-ray irradiation part 2, by control of the X-ray irradiation part shunting control section 76 is made to shunt the center O of an irradiation field (drawing 3 step 14), The irradiation timing signal from the beam irradiation timing signal generation part 75 performs irradiation control of the beam for a therapy (drawing 3 step 15). If it is checked that Step 12 is not enough as the degree of coincidence of the treated area K and beam center O, the work from Step 3 will be repeated. By one exposure of a beam, also when a dose is not enough, the work from Step 3 is repeated.

[0020]Next, the relation between a spirogram signal, the irradiation timing signal of X-rays, and the irradiation timing signal of a beam is explained. Drawing 5 (A) is a spirogram signal which shows the situation of breathing generated based on the signal acquired from the respiration-signals sensor 71 arranged on a patient's breast etc. If a patient's breathing is stabilized, a spirogram signal will also be stabilized, and the cycle becomes almost fixed. Suppose that it is the breathing cycle in this state t_0 about the deepest part of tau and inhalation of air (drawing 5 (A)). Since the organ is the largest before and behind deepest part t_0 of expiration, and there is also least movement of a treated area, if the period of $deltat_1$ centering on t_0 is irradiated with X-rays and an X-ray image is acquired, the stable X-ray image will be acquired. Period $deltat_1$ centering on this t_0 sets a judging level as Lth, for example on the basis of deepest part t_0 of a spirogram signal, and it is obtained when a spirogram signal generates in the period which fell from this level (drawing 5 (A)). It irradiates with X-rays between period $deltat_1$ centering on t_0, and asks for the gap with the treated area K and beam center O using the X-ray image acquired by this. And when checking that performed positioning of the treatment table 3, amended the gap, and the gap has become below a predetermined value, The X-ray irradiation part 2 is evacuated from the beam center line O, the irradiation timing signal (drawing 5 (C)) generated in the way similar between period $deltat_2$ centering on deepest part t_0 of subsequent expiration performs irradiation control of a beam irradiation part, and it irradiates with a beam. Although the position of a treated area moves by a patient's respiratory movement, Since the treated area K will return to the position (position of the center O of an irradiation field) previously checked by deepest part t_0 of the spirogram if breathing is stable, After performing positioning, the center O of the irradiation field of a beam can catch the treated area K certainly by irradiating the period centering on deepest part t_0 of a spirogram signal with a beam. With the passage of time, by causes other than breathing, since ********** Lycium chinense has a beam center, the position of a treated area will make correction of the localization by X-ray irradiation, and a position repeatedly [of a beam / an exposure and by turns]. Although the above was explained by using an X-ray CT picture as picture information including a patient's treated area prepared beforehand, it does not limit to this.

[0021]Embodiment 2., next Embodiment 2 are described based on drawing 6, drawing 7, drawing 8, and drawing 9. Drawing 6 is a lineblock diagram concerning Embodiment 2. What attached the same numerals as drawing 1 in drawing 6 shows an identical content or the thing of a function. The X-ray irradiation part arranged at the position 2B shifted [position] from the center of the irradiation field of a beam, and 4B are X-ray image television parts which televise the X-rays from X-ray irradiation part 2B. At Embodiment 1, although the X-ray irradiation part 2 was arranged on the line of the center line 11 of the irradiation field of a beam, by Embodiment 2, it arranges in the position which avoided the center line 11 of the irradiation field of a beam. The function of the computer 5 and especially the function of the irradiation timing signal generator 7 are the substantially same

contents as what is shown in drawing 2 except for the portion explained below. However, the X-ray irradiation part evacuation control section 76 is unnecessary.

[0022]Next, the operation is explained. In the flow chart of Embodiment 2 shown in drawing 7, the step as the case of Embodiment 1 with step ** to the same step 13 is stepped on and advanced. An irradiation timing signal is generated to period deltat$_1$ (drawing 8 (B)) centering on deepest part t_0 of the expiration of a spirogram signal (drawing 8 (A)), X-ray irradiation part 2B is controlled by this, and it irradiates with X-rays, and if it is checked that the center O and the treated area K of an irradiation field are in agreement in predetermined accuracy, it will irradiate with a beam by irradiation timing signal deltat$_2$ (drawing 8 (C)) obtained succeedingly (drawing 7 step 14). When the exposure of a beam is still more nearly required, it returns to step **, and it carries out in order of the exposure of X-rays, the check of a position, and the exposure of a beam. Although X-ray irradiation will be performed from direction deltatheta which is different from the direction which irradiates with a beam in this case for a while and this will perform alignment of beam center O of the treated area K and a beam, This constitutes and uses the image amended by deltatheta, when a central projection picture is constituted using the image data based on an X-ray CT image.

[0023]Since it becomes unnecessary to make the X-ray irradiation part 2 like Embodiment 1 shunt for the exposure of a beam in the stage which performed X-ray irradiation and finished alignment when it has such composition, The time which shunting of X-ray irradiation part 2B takes becomes unnecessary, and the exposure of a beam is succeedingly made to the coincidence check of the center of the treated area K and a beam. The mechanism for evacuating X-ray irradiation part 2B becomes unnecessary.

[0024]Since the irradiation control of X-rays and the irradiation control of a beam can be changed to the inside of a short time and can be performed, Period deltat$_1$ which performs X-ray irradiation between period deltat in one irradiation timing as shown in drawing 9, and period deltat$_2$ which performs an energy ray Every one. Or two or more period deltat$_{11}$ which performs X-ray irradiation, deltat$_{12}$---, and two or more period deltat$_{21}$ and deltat$_{22}$--- which perform an energy ray can be set up by turns (the case of the latter setting out between two or more terms is shown in the figure). The position gap by a respiratory movement can be lessened all the more because the exposure of a beam will be made from the localization within a time [very near] if it does in this way.

[0025]Embodiment 3., next Embodiment 3 are described. Drawing 10 is a lineblock diagram concerning Embodiment 3. What attached the same numerals as drawing 1 and drawing 6 in drawing 10 shows an identical content or the thing of the same function. It is the 2nd X-ray irradiation part in which 21 intersects the 1st X-ray irradiation part, and the direction of radiation intersects the direction of radiation of said 1st X-ray irradiation part 22. 81 is an irradiation control part of the 1st X-ray irradiation part, and 82 is an irradiation control part of the 2nd X-ray irradiation part. 1st I, I, and 412 correspond to the 1st X-ray irradiation part 21 in the 1st video-signal-processing part 411, and 2nd I, I, and 422 are provided in the 2nd video-signal-processing part 421 corresponding to the 2nd X-ray irradiation part 21. By relating with the picture information which acquired the position of the treated area in this skeleton image by the X-ray CT image, since a patient's skeleton image can be grasped in three dimensions from this X-ray image by performing X-ray irradiation from the direction which crosses in this way, The position of the treated area K can be pinpointed in three dimensions in a skeleton image.

[0026]Art of pinpointing the position of the treated area K on an X-ray image by matching the landmark specifically given to the skeleton image acquired using the picture information of the image data file 6 and the skeleton image actually acquired by the patient's X-ray irradiation is performed about the picture information of two crossing axes, By compounding the result in vector, the position of the treated area K can be pinpointed in three dimensions in a skeleton image. Namely, the 1st X-ray image acquired by the exposure of the 1st X-ray irradiation part 21, From the skeleton image acquired by irradiating with by the X-ray irradiation part of the imagination from a skeleton image and the same direction displayed on said 1st X-ray irradiation part 21 using the picture information of an image data file, the position of the treated area seen from the direction of radiation of the 1st X-ray irradiation part 21 can be grasped. The 2nd X-ray image that similarly was acquired by the exposure of the 2nd X-ray irradiation part 22, From the skeleton image acquired from the skeleton image and the same direction which were displayed on said 2nd X-ray irradiation part 22 using the picture information of an image data file by irradiating with by the X-ray irradiation part of imagination, the position of the treated area seen from the direction of radiation of the 2nd X-ray irradiation part 22 can be grasped. Since the direction crosses, said 1st X-ray irradiation part 21 and said 2nd X-ray irradiation part 22 can pinpoint the position of a treated area in three dimensions. By carrying out by changing one by one in time sharing, the exposure by the 1st X-ray irradiation part and the exposure by the 2nd X-ray irradiation avoid interference with the X-ray image by the 1st X-ray irradiation part, and the X-ray image by the 2nd X-ray irradiation part, and can prevent generating of the error in the localization.

[0027]

[Effect of the Invention]As explained above, the beam irradiation therapeutic device concerning this invention, The irradiation timing signal generator which is controlled synchronizing with a patient's spirogram signal and generates an irradiation timing signal in the specific period of one cycle of this spirogram signal, The X-ray irradiation part which irradiates with X-rays the portion which is controlled by this irradiation timing signal and includes a patient's treated area, The X-ray image television part which televises the X-ray image acquired by the exposure of these X-rays, By comparison of picture information including a patient's treated area prepared beforehand and the picture information obtained from said X-ray image television part, have a localization part which checks the position of said treated area, and by the X-ray irradiation of some periods of one cycle of a breathing cycle. Since the localization of a patient's treated area is performed and it was made to irradiate with the beam for a therapy based on the result, it is effective in the ability of the amount of X ray contamination for checking a treated area to constitute few beam irradiation therapeutic devices.

[0028]The X-ray irradiation part which irradiates with X-rays the portion which is controlled synchronizing with a patient's spirogram signal, and irradiation control is carried out with the irradiation timing signal generated in the specific period of one cycle of this spirogram signal, and includes a patient's treated area, The X-ray image television part which televises the X-ray image acquired by the exposure of these X-rays, The picture information of an X-ray CT image including a patient's treated area prepared beforehand, and the localization part which checks the position of said treated area by comparison of the picture information obtained from said X-ray image television part, The position control part which it is controlled by the signal from a localization part, and is controlled in the direction which loses the position gap with the position of said treated area, and the beam center of the beam for a therapy, It has a beam irradiation part which is controlled by an irradiation timing signal by a patient's treated area, and irradiates it with the beam for a therapy after the end of the position control by said position control part, Since it was made to irradiate with the beam for a therapy with the postoperativus irradiation timing signal which performed

X-ray irradiation with the irradiation timing signal, and performed position gap amendment with the localization of a patient's treated area, It is effective in the ability of the amount of X ray contamination for checking a treated area to constitute a beam irradiation therapeutic device with high exposure accuracy few.

[0029]Since it synchronizes with a spirogram signal and was made to perform generation of the irradiation timing signal during the expiration, there is an effect based on collection of the position information on a treated area with few position gaps by a body motion which can constitute a beam irradiation therapeutic device with few a patient's amounts of X ray contamination.

[0030]Since it was made to irradiate a treated area with the beam for a therapy with an irradiation timing signal on condition that the position gap with the position of a treated area and the center of the irradiation field of the beam for a therapy which were acquired from the X-ray image television part is below a predetermined value, There are few a patient's amounts of X ray contamination, and there is an effect which can constitute the beam irradiation therapeutic device which can limit beam irradiation to a treated area and can perform it.

[0031]Irradiating with a beam cuts without moving the position of an X-ray irradiation part mechanically, since it has arranged in the position which does not lap with the irradiation field of the beam for a therapy which turns to a treated area the X-ray irradiation part with which it irradiates towards a portion including a treated area, and irradiates with it. As a result, since the time lag to the exposure of the beam for a therapy can be made small through the work of localization control of a treated area, there are few a patient's amounts of X ray contamination, and there is an effect which can constitute still fewer beam irradiation therapeutic devices of the position error by a body motion.

[0032]The specific period in 1 cycle of a spirogram signal is divided in two or more periods, Since it assigns the period of X-ray irradiation, and during the exposure of the beam for a therapy and the irradiation timing signal of X-rays and the irradiation timing signal of the beam for a therapy were generated in each period, the time lag from collection of the position information on a treated area to the exposure of the beam for a therapy is made small. As a result, since X-ray irradiation and beam irradiation can be performed continuously in time, it is effective in the ability of a patient's amount of X ray contamination to constitute few high-precision beam irradiation therapeutic devices.

[0033]Since it was made to collect the information which irradiates with X-rays a portion including a treated area from 2 crossing or 2 or more directions, and starts the position of a treated area from the X-ray image, it is effective in the ability of the amount of X ray contamination of the patient based on the three-dimensional position information on a treated area to constitute few beam irradiation therapeutic devices.

[0034]Since the beam for a therapy was considered as the composition using X-rays, an electron beam, a charged particle beam, a heavy particle beam, or a neutron beam, it is effective in the ability of the amount of exposures of a patient's X-rays to constitute the beam irradiation therapeutic device which can treat few cancer cells.

[0035]The beam irradiation therapeutic device concerning this invention, An irradiation timing signal is generated in the periodic period in the constant level of the periodic spirogram signal by a patient, The portion which includes a patient's treated area by an X-ray irradiation part synchronizing with this irradiation timing signal is irradiated with X-rays, Since the position of a patient's treated area is checked and it was made to irradiate the patient's treated area by a beam irradiation part with the beam synchronizing with said irradiation timing signal, it is effective in the ability of the amount of X ray contamination for checking a treated area to constitute few beam irradiation therapeutic devices.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a lineblock diagram applied to operation at the gestalt 1.
[Drawing 2]It is a partial lineblock diagram of the gestalt 1 at operation.
[Drawing 3]It is a flow chart of Embodiment 1.
[Drawing 4]It is an explanatory view of the alignment procedure in Embodiment 1.
[Drawing 5]It is a figure explaining the relation between the spirogram signal in Embodiment 1, and an irradiation timing signal.
[Drawing 6]It is a lineblock diagram applied to operation at the gestalt 2.
[Drawing 7]It is a flow chart of Embodiment 2.
[Drawing 8]It is a figure explaining the relation between the spirogram signal in Embodiment 2, and an irradiation timing signal.
[Drawing 9]It is a figure explaining the relation between other spirogram signals and an irradiation timing signal in Embodiment 2.
[Drawing 10]It is a lineblock diagram concerning Embodiment 3.
[Drawing 11]It is an explanatory view of a conventional example.
[Drawing 12]It is an explanatory view of the alignment procedure of a conventional example.
[Drawing 13]It is a figure explaining the relation between the spirogram signal of a conventional example, and an irradiation timing signal.
[Description of Notations]
1 A beam irradiation part and 11 The center of an irradiation field, and 12 A dosimeter and 13 Collimator, 2 an X-ray irradiation part, 3 operating table, 4 X-ray-image television part, and 41 image intensity fire (I.) I) 42 video-signal-processing parts and 5 A computer and 51 Image constituting part, 52 A localization part and 53 A position control part and 54 Localization information output part, 6 A graphics file and 7 A spirogram signal generator and 71 Respiration-signals sensor, 72 A respiration-signals generating part and 73 A condition signal generating part, the irradiation timing signal generator for 74 X-rays, 75 A beam irradiation timing signal generation part, 76 X-ray irradiation part shunting control section, 8 X-ray-irradiation control section, 9 beam-irradiation control section, and 10 An operation control part and 10a Image comparison display, 10b A picture display and 10c [A communication apparatus and 40 / Communication wire.] A character display and 10 d A keyboard, 10e navigational panel, and 10 f A tablet, 20 X-ray CT scanners, and 30

[Translation done.]